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INDUSTRIAL WASTE SURVEY REPORT

Environmental Health Center
Cincinnati, Ohio

May 1953

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INDUSTRIAL WASTE SURVEY REPORT

Darling and Company
Melvindale, Michigan

May 6 to May 25, 1953

NATIONAL TECHNICAL
INFORMATION SERVICE

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Center
Cincinnati, Ohio

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I. GENERAL INFORMATION

1. Organization of Survey

This survey was a cooperative study conducted by the Darling and Company Melvindale, Michigan, the Michigan Water Resources Commission, and the Environmental Health Center of the Public Health Service.

Analytical determinations were performed by Public Health Service chemists in a mobile laboratory located on the grounds of the Wayne County Sewage Treatment Plant at Wyandotte, Michigan. Personnel of the Darling and Company aided the field survey staff in becoming familiar with liquid waste sources and assisted in obtaining hydraulic data.

2. Dates of Survey

May 6 to May 25, 1953. Samples collected on May 6, 7, 8, 14, and 25.

3. Purpose of Survey

This survey was conducted to determine the characteristics of the process wastes discharged from the plant to Rouge River. This project was a part of the continuing study of boundary waters pollution being conducted for the International Joint Commission.

4. Personnel Participating

DARLING AND COMPANY
G. J. Syring, Plant Superintendent

PUBLIC HEALTH SERVICE
D. M. Taylor, Public Health Engineer
S. Soneda, Asst. Sanitary Engineer
C. Shadix, Chemist
S. Pinkoski, Chemist
C. Hirth, Chemist
P. Jones, Engineering Aide
M. D. Currey, Laboratory Asst.

5. Location of Plant

This plant is located at 3350 Greenfield Road, Melvindale, Michigan.

6. Raw Materials

Raw materials are animal carcasses, bones, fleshings, waste household fats.

7. Production

The plant produces fats, bone meals and tankage. It also salts and cures raw hides for shipment to tanneries.

8. Operations

The plant operates 24 hours per day, 6 days per week.

9. Employees

The number of employees is about 250.

10. Water Supply

Melvindale city water is used for sanitary purposes. Rouge River water is used for cooling and general process purposes.

11. Sewers

Water-carried process wastes are discharged through two outfall lines to the Rouge River.

12. Sanitary Wastes

Sanitary wastes are discharged to the Melvindale municipal system.

II. MANUFACTURING PROCESS

Bones, meat trimmings, dead animals, and waste household fats are rendered for conversion to fats and dry animal feed. The materials are weighed, crushed, reduced in size, and charged to cookers for "melting." The material is dehydrated at atmospheric pressure with the grease separating from the bones and other solid materials. A vacuum of approximately 1 inch is pulled on the vats at the end of the cook with barometric condensers. The fats are put in containers, while the other solids are crushed, dried, and sacked.

III. WASTE SOURCES AND REMEDIAL MEASURES

Process waste effluents are discharged into the Rouge River. They consist, for the most part, of clean-up water and barometric condenser water. These water-carried wastes are passed through separating basins before being discharged to the outfall sewer.

Clean-up water is first passed through interceptors and then a screen (30 mesh) before flowing through a basin, 11' x 46' with an effective water depth of 5'-6". This basin is divided into four sections by equally spaced baffles which remove floating materials. The wastes flow under these baffles and overflow to a sewer discharging to a sump.

Barometric condenser water passes through another basin 30' x 40' with an effective water depth of 4'. Two skimmers are provided extending half way across the length of the basin so arranged that all wastes coming in must flow by them before entering the outlet. The basin effluent discharges to the same sump as the settled wash water.

IV. SURVEY PROCEDURES

13. Sample Collection

Plant operations were normal during the period of the survey. Continuous level recorder charts indicated fairly constant waste flows and equal portions of samples were taken for compositing. Separate samples were composited in one liter glass-stoppered bottles for the oil determination. Samples were collected at 30 minute intervals over 8 hour periods from 8:00 AM to 4:00 PM.

The combined wastes were sampled in a manhole just before discharge to the Rouge River. The raw water intake was also sampled in order to compute net waste components discharged from the plant.

14. Flow Data

The two outfall waste lines, as well as the sewers at the sampling manhole were submerged. One of the two sewer lines leading from the sump to the sampling manhole was plugged and two flow measurements were made by the salt concentration method in the other sewer containing the combined flow.

15. Laboratory Analyses

The following laboratory determinations were made on the samples:

A. Total solids
B. Total volatile matter
C. Total suspended solids
D. Suspended volatile matter
E. BOD - 5 day at 20°C
F. Oils
G. pH

The procedures followed in making the determinations, with the exception of oils, were those given in "Standard Methods for the Examination of Water and Sewage," 9th edition. The procedure for oils was that given in "Analytical Methods for Boundary Waters Quality Control," by the Board of Technical Advisers of the International Joint Commission.

V. EXPLANATION OF LABORATORY ANALYSES

A brief explanation of the various laboratory determinations is given as an aid in the interpretation of the analytical results reported.

16. Solids

Suspended solids are insoluble solids which float on the surface of the liquid, remain in suspension, or settle out on standing. They are determined by filtering samples through asbestos mats in Gooch crucibles. Total solids consist of all the solids in a sample which do not volatilize at 103°C

or less. They include both suspended and dissolved solids. Volatile solids, or volatile matter, are those solids in the sample which are lost on ignition at a temperature of 600°.C for 15 minutes.

Suspended solids cause water to appear turbid and unsightly. Settleable suspended solids are objectionable because they cause silting and sludge banks. Suspended solids are particularly objectionable in water supplies used for domestic and industrial purposes. Relatively large amounts of dissolved solids may be objectionable in domestic water supplies for physiological reasons, and in industrial water supplies for process reasons. The volatile solids (matter) results are obtained by an empirical method but they are intended to indicate the organic material content of the solids.

17. B.O.D.

The biochemical oxygen demand of sewage, polluted waters, or industrial wastes, is the oxygen (in ppm) required during stabilization of the decomposable organic matter by aerobic bacterial action. The rate of oxygen demand is dependent on both time and temperature and consequently the standard conditions of 5 days' incubation at 20°C. are usually used for the test. Approximately 68 per cent of the oxygen demand of the carbonaceous material present in normal domestic sewage is satisfied under the conditions of 5 days' incubation at 20° C. The oxygen demand rates of industrial wastes, however, may or may not follow the typical oxidation curve for domestic sewage. It would be necessary to incubate a particular sample of waste for such a period of time that no more oxygen demand was exerted, in order to determine the total B.O.D.

High B.O.D. values are objectionable from a stream pollution standpoint because they reduce the oxygen resources of the streams, adversely affecting the aquatic life. If the oxygen content is depleted, anaerobic conditions develop and the water is rendered undesirable for supply and recreational purposes.

18. Oils

The oil results were obtained by extracting the samples with a 1:1 mixture (by volume) of diethyl ether and carbon tetrachloride. These results represent all of the materials which are soluble in these organic solvents, and not just the true oils as such.

Oily materials are objectionable from the standpoint of stream pollution because they are unsightly, damaging to wildlife and aquatic life, detrimental to recreational facilities, and interfere with treatment processes for public and industrial water supplies. Oily films on the surfaces of lakes and streams interfere with the normal reaeration of the water and may be difficult to remove. Certain sludges may contain oily materials which may be toxic to bottom fauna and flora.

19. pH

The symbol "pH" denotes the negative logarithm of the hydrogen-ion normality. The pH value indicates the relative acidity or alkalinity of a solution, being lower with higher degrees of acidity.

pH data are helpful in measuring the effects of acid and alkaline wastes on natural surface waters. Acids causing pH values below 4.0 and alkalies causing pH values above 10.0 are undesirable and hazardous for fish life in waters which are not naturally so acid or alkaline. pH is also an important factor when considering treatment for domestic and industrial water supplies.

VI. DISCUSSION OF RESULTS

Daily and average results showing gross and net concentrations and daily quantities of waste constituents discharged from the plant, are given in Table 1.

Approximately 93 per cent of the total solids are suspended.

Approximately 68 per cent of the total solids are volatile, indicating that approximately two-thirds of the solids are organic in nature.

Approximately 69 per cent of the suspended solids are volatile.

Net suspended volatile matter constitutes approximately all of the net volatile matter, indicating that approximately all of the organic matter is in suspension.

VII. SUMMARY

(1) This plant renders animal carcasses, bones, fleshings, and waste household fats to produce fats, bone meals, and tankage.

(2) The two main sources of liquid wastes are barometric condenser water and clean-up water.

(3) Clean-up water is screened and passed through a settling-skimming basin. Barometric condenser water is passed through another settling-skimming basin. The combined effluents are discharged to the Rouge River.

TABLE 1

Public Health Service
Environmental Health Center
Cincinnati, Ohio

Daily Gross and Net Concentrations of Waste Constituents - ppm
Darling & Company, Melvindale, Michigan

Date 1953	B.O.D. Gross	B.O.D. Net	Total Solids Gross	Total Solids Net	Total Volatile Matter Gross	Total Volatile Matter Net	Suspended Solids Gross	Suspended Solids Net	Suspended Volatile Matter Gross	Suspended Volatile Matter Net	Oils Gross	Oils Net	pH
	ppm		ppm		ppm		ppm		ppm		ppm		
Final Effluent													
May 6	99	88	407	20	156	27	52	20	39	20	20	14	7.4
7	129	118	490	42	209	30	70	42	48	30	147	45	7.6
8	181	160	518	70	166	31	93	69	45	31	39	23	7.9
14	133	118	455	60	184	41	86	50	63	41	82	69	7.4
25											40	19	
Average	136	121	468	48	173	32	75	45	49	31	64	34	
Raw Water													
May 6	11		387		129		32		19		6		7.4
7	11		448		179		28		18		102		7.6
8	21		448		135		24		14		7		7.6
14	15		395		143		36		22		13		7.5
25											21		
Average	15		420		147		30		18		30		

Table 2 - Daily Gross and Net Quantities of Waste Constituents - Pounds Per Day

													Flow-MGD
May	6	1010	905	4170	206	1600	276	533	206	400	206	206	144	1.23
	7	1290	1180	4900	420	2090	300	700	420	480	300	1470	450	1.20
	8	1750	1550	5010	679	1604	300	900	668	435	300	290	222	1.16
	14	1720	1480	5880	750	2380	513	1110	625	788	513	1060	862	1.50
	25											424	201	1.27
Average		1443	1279	4990	514	1919	347	811	480	526	330	862	470	1.27

(4) The average net concentrations and average total net daily quantities of waste constituents discharged from the plant are as follows:

Waste Constituent	Concentrations ppm	Quantities Lbs/Day
B.O.D. - 5 day	120	1280
Total Solids	48	510
Total Volatile Matter	32	350
Suspended Solids	45	480
Suspended Volatile Matter	31	330
Oils	34	470
pH	7.4-7.9	
Flow - MGD		1.27

(5) Suspended solids constitute about 93 per cent of the total solids.

(6) Suspended volatile matter constitutes about 95 per cent of the total volatile matter, indicating that most of the organic matter is in the suspended solids.